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THE CONDUCT OF DOMESTIC MONETARY POLICY

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ABSTRACT

This paper develops the view that monetary policy operates within a set of basic constraints that limit the set of outcomes that it can achieve. These include constraints on aggregate supply behavior that determine how a given path of nominal income growth will be divided between inflation and output growth, as well as "velocity" constraints that influence the path of nominal income growth that will result from any given time path for the monetary base, monetary aggregates, or interest rates. The interaction of monetary policy decisions with shifts in constraints helps to explain the sources of deteriorating macroeconomic performance in the 1970s and early 1980s.

The role of aggregate supply behavior is illustrated with a one-equation approach to the econometric problem of predicting how changes in nominal GNP growth will be divided between inflation and real GNP growth. The results from the equation estimated through 1980 are used to examine the behavior of inflation during the 1981-82 recession, and to predict the behavior of inflation and unemployment that would accompany alternative paths of nominal GNP growth after 1982.

The role of velocity is examined in a new set of multivariate exogeneity tests using the vector-autoregressive (VAR) approach for three separate sample periods (1953-61, 1962-70, and 1971-79). The major conclusions are that the monetary base has no significant explanatory role for spending changes. The Treasury bill rate appears to carry the main explanatory power, working directly on spending in the 1950s and indirectly through the money multiplier in the 1970s.

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I. INTRODUCTION

Monetary policy has traditionally shared with fiscal policy joint responsibility for attainment of the ultimate macroeconomic goals--full employment, price stability, and maximum feasible growth in per-capita real-income. In the decade after 1973 macroeconomic performance deteriorated in most major industrialized nations, with high unemployment and inflation rates, and lower growth in per capita real income. The design of new procedures for the conduct of domestic monetary policy must start from an analysis of past performance. An assessment is required of the role, if any, that monetary policy played in contributing to worsened macroeconomic performance, and of the implications of identifiable errors of policy and procedures.

A well-established view holds that real phenomena like the unemployment rate and real per-capita income growth are independent of monetary policy, which guides the evolution of nominal monetary aggregates, nominal bank reserves, and nominal interest rates. As stated by Milton Friedman (1968) and other traditional monetarists, this interpretation of monetary neutrality holds in the long run, while nominal monetary phenomena are capable of influencing real variables in the short run. A stronger version of monetary neutrality is maintained in the Lucas-Sargent-Wallace (LSW) "policy ineffectiveness proposition," which holds that only unanticipated movements in nominal monetary aggregates can influence real output (see especially Sargent and Wallace, 1975). Subsequent empirical work with quarterly data for the U. S. (Barro and Rush, 1980) implies that monetary changes must be neutral for output over periods longer than one quarter.[1]

Since money is held in the monetarist and LSW views to be neutral for real variables over periods ranging from one quarter to a long run of perhaps two-to-five years, it might be concluded that monetary policy could not be held responsible for the poor performance of real variables after 1973. The same reasoning would hold monetary policy solely responsible for faster inflation. Indeed, a standard prescription for monetary policy has been to maintain tight control over the growth rate of monetary aggregates or of the monetary base along a steadily decelerating path to eliminate inflation.

This paper develops an alternative view of the consequences of monetary policy. A long time is required for monetary policy to become neutral, i.e., for its effect on real variables to vanish. Alternative scenarios for the nominal money supply can make the difference between smooth or oscillating paths for real variables over periods of a decade or more. Monetary policy operates within a set of basic constraints that limit the set of outcomes that it can achieve. These include constraints on aggregate supply behavior that determine how a given path of nominal income growth will be divided between inflation and output growth, as well as "velocity" constraints that influence the path of nominal income growth that will result from any given monetary policy, whether stated in terms of the monetary base, monetary aggregates, or interest rates. The interaction of monetary policy decisions with

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[1]The only variable with significant explanatory power in the equation used by Barro and Rush to proxy for the concept of "anticipated monetary changes" is a one-quarter lag on actual monetary change. Thus it takes only a single quarter for a monetary change to become fully anticipated. The policy ineffectiveness proposition is rejected in recent empirical papers by Mishkin (1982) and Gordon (1982b).

shifts in the constraints helps to explain the sources of deteriorating macroeconomic performance. Explicit consideration of the constraints is required in the design of new procedures.

The presentation of a paper at an international conference on the assigned topic of "domestic monetary policy" poses a serious problem of delimiting scope. Ideally those aspects of domestic monetary policy should be isolated that are of such central importance as to be relevant in every country. The approach taken here is to develop a common theme that monetary policy operates in the face of constraints, and to regard the constraints as a dimension of difference across nations.

The constraints to be emphasized in the paper fall into the two major categories of aggregate supply and velocity constraints. Among the aggregate supply constraints faced by most nations are (1) a short-run tradeoff between inflation and unemployment, (2) "inertia" in the adjustment of inflation to nominal disturbances, (3) the absence of a long-run tradeoff between inflation and unemployment, (4) the exposure of the short-term tradeoff to the influence of supply shocks, and (5) the influence on the tradeoff slope of the economy's degree of openness and its exchange rate regime. For purposes of illustration the paper concentrates on the operation of these aggregate supply constraints in the United States but refers to likely differences in other nations, particularly the lesser extent of inflation inertia and the greater degree of openness.

Among the determinants of monetary velocity that influence the path of nominal spending for a given path of the monetary base or a monetary aggregate are (1) the level and change in fiscal deficits, (2) shifts in the demand function for a given monetary aggregate as a result of changes in tastes or innovations in financial markets, and (3) shifts in the expenditure function for private goods and services related to the cyclical dynamics of the demand for durable goods and to fluctuations in the foreign trade surplus due to exchange rate movements or exogenous foreign disturbances.

Again the paper concentrates on the consequences of velocity shifts in the United States, which in recent years have been particularly related to financial innovation and the appreciation of the dollar, which in turn has been partly caused by the anticipation of future fiscal deficits. Velocity shifts in other nations may have a different mix of sources but are still amenable to the same general policy prescription outlined below. The U. S. situation is also unique in the degree of independence of the central bank and the lack of coordination of monetary and fiscal policy, which makes fiscal policy more of a constraint than is the case elsewhere. In other nations it may be more fruitful to regard monetary and fiscal policy as part of a coordinated policy package, rather than regarding fiscal policy as imposing constraints on monetary policy.

Both the aggregate supply and velocity factors are treated as "constraints" because they limit the ability of the central bank to achieve its ultimate goals of price stability, full employment, and maximum real income growth. What appears to be a constraint from the viewpoint of the central bank may be the result of maximizing behavior by individuals in the private economy or politicians influencing the government's fiscal decisions. For instance, the dilemma for anti-inflationary monetary policy posed by inflation inertia in the U. S. results indirectly from the American system of staggered three-year wage contracts, which in turn can be explained by a particular institutional history of unionization and labor strife in the early postwar years.[2]

The fact that central banks in different nations face a differing set of constraints does not, of course, fully explain differences in economic outcomes. For instance, some commentators point to domestic monetary policy choices as the main explanation of "why West Germany and Japan coped with the oil crisis far better than the United States, or why they have been more successful during the past decade in avoiding high inflation than Britain or the United States" (Friedman, 1983). In my interpretation the central banks in West Germany, Britain, and Japan face a different set of constraints than in the U. S., particularly a smaller degree of inflation inertia. Thus, maximizing subject to this constraint, it is optimal for the central banks of these three countries to react to an oil shock with less monetary accommodation than the U. S. central bank. The low-inflation outcomes in West Germany and Japan, then, resulted from the interaction of central bank decisions and constraints, not from independent decisions taken by central banks operating in a vacuum. The wide choice set open to central banks implied by Friedman's comment is, I believe, well illustrated by the different outcome in Britain as compared to West Germany and Japan.

Examples developed in the paper show how aggregate supply constraints can be taken explicitly into account in designing a path for

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[2]An explanation of the origins of three-year union contracts in the United States and the contrast with shorter-term contracts in the United Kingdom and Japan is contained in Gordon (1982c). The general idea of the central bank operating in the face of constraints in developed most fully in Gordon (1975), which builds on ideas contained in Reder (1948).

nominal GNP growth that aims to bring about stable future growth in output with a stable (but non-zero) rate of inflation. Much of the discussion in the last half of the paper compares nominal GNP targeting with the traditional dichotomy between money supply and interest rate targeting. It shares with recent papers by Fellner (1982) and Bryant (1982)(1983) an emphasis on shifting the attention of the central bank from monetary variables to the ultimate targets of policy, while differing on the appropriate length of horizon and details of implementation.

II. AGGREGATE SUPPLY BEHAVIOR

Basic Identities and Hypotheses

The term "aggregate supply behavior" refers to the set of factors that influence how the growth rate of nominal GNP is divided between inflation and real GNP. If the growth rate of nominal GNP is viewed as predetermined, depending on monetary growth and other factors determining velocity growth, then the three key macroeconomic growth rates of nominal GNP (y), real GNP (q), and the GNP deflator (p) can be determined with only two equations (here I adopt the notation that upper-case letters stand for levels and lower case letters stand for proportional rates of change).

One equation is the identity linking the three:

$$y_t \equiv p_t + q_t, \tag{1}$$

where the _t_ subscripts designate the time period. This can be converted into a more useful form if we subtract from each side of (1) the growth rate of "natural" real GNP (q_t^N). This is the growth rate of the amount of real GNP that the economy can achieve when operating at the "natural rate of unemployment," defined in turn as the unemployment rate compatible with steady nonaccelerating inflation in the absence of supply shocks.

$$y_t - q_t^N \equiv p_t + q_t - q_t^N \qquad (2)$$

Even though (2) is an identity, it contains an important kernel of truth about the underlying source of inflation. If real GNP tends to gravitate to its "natural" level in the long run, then in the long run actual and natural real GNP growth must be equal ($q_t - q_t^N = 0$), and then inflation is simply the excess of nominal GNP growth over the growth rate of natural real GNP ($p_t = y_t - q_t^N$). I call this excess nominal GNP concept "adjusted nominal GNP growth" ($y_t - q_t^N$). Thus the famous phrase "inflation is always and everywhere a monetary phenomenon" (Friedman, 1963) should really be replaced by "inflation in the long run is always and everywhere an adjusted nominal GNP phenomenon."

The identity (2) identifies three reasons why inflation does not always and everywhere vary in proportion to movements in monetary growth. First, at least in the short run, inflation can fall below $y - q^N$ if real GNP grows faster than natural real GNP ($q - q^N$), and vice versa. Second, inflation can speed up with constant nominal GNP growth if there is a slowdown in the growth rate of natural real GNP, due, for instance, to the much-discussed worldwide post-1973 productivity growth slowdown. Third, nominal GNP growth by definition is equal to monetary growth plus velocity growth ($y = m + v$), and there is no reason for velocity growth to be constant under every alternative monetary regime. For instance, the velocity of the M1 money supply concept in the U. S. (currency and demand deposits) exhibited a decade-long decline in the 1930s and a 36-year-long rise between 1945 and 1981. Between 1981 and 1983, velocity once again declined.

One more implication of identity (2) provides an important link between inflation and unemployment, two of the basic goal variables of monetary policy. The difference between the unemployment rate and the natural rate of unemployment is closely related to the "output ratio," that is, the ratio of actual to natural real GNP. This relationship, usually called "Okun's Law," has held up extremely well in the United States through the economic turmoil of the last decade.[3] This means that movements in the unemployment rate can be tracked accurately given knowledge of the current output ratio, for which we use the symbol $\hat{Q}_t$ (= Q_t/Q_t^N). Inflation and the output ratio are linked together by identity (2), once we take note of the fact that:

$$\hat{Q}_t - \hat{Q}_{t-1} \cong q_t - q_t^N$$

Thus (2) becomes

$$y_t - q_t^N = p_t + \hat{Q}_t - \hat{Q}_{t-1} \qquad (3)$$

Thus, given some predetermined value of adjusted nominal GNP growth

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[3]Estimates of the Okun's Law relationship between the U. S. unemployment rate and the output ratio are contained in Gordon (1982a, p. 94). The relationship between the demographically weighted unemployment rate and the output ratio remains completely stable over the 1954-80 period. The natural aggregate unemployment rate drifts up relative to the constant weighted natural rate as a result of demographic shifts. The relationship has recently been studied for Japan in Hamada and Kurosaka (1983).

$(y_t - q_t^N)$ and last period's output ratio $(\hat{Q}_{t-1})$, equation (3) contains the two unknown variables of central interest in macroeconomics, the inflation rate (p_t) and the output ratio $(\hat{Q}_t)$.

The additional equation needed to determine the value of both unknowns is a dynamic expectational Phillips tradeoff equation, which is sometimes, following Friedman (1970) called "the missing equation." In its simplest form this states that the inflation rate depends on the expected rate of inflation (p_t^e), the output ratio $(\hat{Q}_t)$, and the influence of some proxy for the effect of supply shocks on inflation (z_t):

$$p_t = p_t^e + b(\hat{Q}_t - 1) + cz_t, \tag{4}$$

where _b_ and _c_ are parameters.

The coefficient on the expected inflation term is assumed to be unity, and therefore (4) incorporates the "natural rate hypothesis." When supply shocks are absent $(z_t = 0)$, inflation remains equal to the expected rate of inflation when the output ratio is unity $(\hat{Q}_t = 1)$, i.e., when the economy is operating at its "no shock" natural rate of output $(Q_t = Q_t^N)$. Inflation tends to accelerate when the output ratio is above unity and to decelerate when the output ratio is below unity. If adverse supply shocks are present $(z_t > 0)$, then inflation can accelerate even when the output ratio is below unity. Among the relevant set of adverse supply shocks in the U. S. have been increases in the relative prices of oil, food, and raw materials; a depreciation of the dollar; increases in indirect taxes; increases in the effective minimum wage; and the rebound of prices after various price control programs. The post-1973 slowdown in productivity growth is taken into account in the measurement of natural real GNP (Q_t^N). Inflation-reducing supply shocks have been limited to the transitory effects of price control programs and, more recently, the partial reversal of the oil shocks and the appreciation of the dollar.[4]

The relationship between inflation and adjusted nominal GNP growth can be seen when the two basic equations are combined. Substituting (3) into (4), we obtain, after some rearrangement:

$$p_t = \frac{1}{1+b} [p_t^e + b(y_t - q_t^N + \hat{Q}_{t-1} - 1) + cz_t] \quad (5)$$

The economy is in long-run equilibrium when $p_t = p_t^e = y_t - q_t^N$ and $z_t = 0$. An acceleration of inflation relative to the expected rate can be caused by an acceleration of nominal GNP growth, a deceleration of natural real GNP growth, a lagged output ratio above unity, and any adverse supply shock.[5]

Nominal GNP Growth, Inflation, and the Output Ratio in U. S. Postwar Business Cycles

This section provides an interpretation of the behavior of inflation and the output ratio in postwar business cycles. Then in the following section we summarize the implications of recent econometric

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[4]This list of supply shocks includes several factors, including the relative prices of oil, food and raw materials, as well as the exchange rate, that also reflect the influence of monetary and fiscal policy. These are termed "supply shocks" solely for terminological convenience.

[5]The concepts and equations in this section are explained in full, both in a graphical and algebraic treatment, in Chapters 8 and 9 of my textbook (1981).

estimates of equation (5) for the effects on inflation and the output ratio of alternative paths for adjusted nominal GNP growth that might be chosen by a central bank conducting domestic monetary policy.

Data for seven postwar business cycles are exhibited in Table 1. The timing of each cycle is dictated by the choices of the National Bureau of Economic Research (NBER), which has established a chronology of U. S. business cycles extending back to 1837. The table shows each business cycle in a grouping of three lines, labelled "expansion," "plateau," and "recession." The "expansion" begins in the calendar quarter designated by the NBER as the official cycle "trough." The "recession" begins in the quarter designated as the official NBER "peak." An intermediate stage is defined here that separates the period between NBER trough and peak into two intervals, divided at the quarter when the output ratio reaches its peak. During the plateau phase, the economy exhibits positive real GNP growth at a rate slower than the natural growth ($0 < q_t < q_t^N$), so the output ratio declines.

The five growth rates in columns (3) through (7) of Table 1 correspond to the famous quantity equation. Growth in money (m) plus velocity (v) equals that in nominal GNP (y), which also equals that in the GNP deflator (p) plus that in real GNP (q). These growth rates do not tell us much about extreme highs and lows experienced by the unemployment rate or the output ratio. Column (9) exhibits the official unemployment rate observed in the first quarter of each of the three cyclical phases. Column (8) exhibits my estimate of the output ratio; a detailed econometric study of equation (4) is used to derive the output ratio consistent with a constant rate of inflation in the absence of supply shocks.

Table 1

Basic Characteristics of U. S. Business Cycles
1949-1982

Phase	Date Phase Begins	Length of Phase in Years	Four-quarter growth rates: Money Supply(m) +	Velocity of M1(v) =	Nominal GNP(y) =	GNP Deflator(p) +	Real GNP(q)	Value at Start of Phase: Output Ratio	Unemployment Rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Expansion	1949:Q4	3.50	4.3	6.5	10.8	3.3	7.5	93.5	7.0
Plateau	---	---	---	---	---	---	---	---	---
Recession	1953:Q2	1.00	0.8	-2.7	-1.9	1.4	-3.3	104.5	2.6
Expansion	1954:Q2	1.50	2.9	5.6	8.5	2.0	6.5	98.3	5.8
Plateau	1955:Q4	1.75	0.8	6.1	6.9	3.6	3.3	103.5	4.2
Recession	1957:Q4	0.75	0.6	-3.2	-2.6	1.0	-3.6	100.5	4.2
Expansion	1958:Q2	1.00	4.5	6.3	10.8	2.7	8.1	95.6	7.4
Plateau	1959:Q2	1.00	-0.6	3.8	3.2	1.5	1.7	100.6	5.1
Recession	1960:Q2	0.75	1.9	-1.4	0.5	0.6	-0.1	98.8	5.2
Expansion	1961:Q1	5.00	3.8	3.9	7.7	1.9	5.8	96.1	6.8
Plateau	1966:Q1	3.75	5.0	2.3	7.3	4.3	3.0	105.7	3.9
Recession	1969:Q4	1.00	5.0	-0.1	4.9	5.0	-0.1	102.3	3.6
Expansion	1970:Q4	2.25	7.7	3.5	11.2	4.6	6.6	98.1	5.9
Plateau	1973:Q1	0.75	4.8	4.7	9.5	7.3	2.2	103.7	4.9
Recession	1973:Q4	1.25	4.4	1.4	5.8	10.1	-4.3	102.6	4.8
Expansion	1975:Q1	3.75	7.1	4.7	11.8	6.5	5.3	94.3	8.2
Plateau	1978:Q4	1.25	7.4	2.7	10.1	8.5	1.6	100.9	5.8
Recession	1980:Q1	0.50	10.8	-5.5	5.3	9.5	-4.2	99.0	6.2
Expansion	1980:Q3	0.50	7.9	8.5	16.4	10.2	6.2	95.5	7.5
Plateau	1981:Q1	0.50	4.5	3.6	8.1	7.7	0.4	97.0	7.3
Recession	1981:Q3	1.50	6.1	-1.6	4.5	5.9	-1.4	95.5	7.4
Average All Cycles (Weighted by length)									
Expansion		2.53	5.1	5.1	10.2	3.8	6.4	95.9	6.9
Plateau		1.28	3.9	3.5	7.4	4.9	2.5	101.9	5.2
Recession		0.98	4.0	-1.4	2.6	5.2	-2.6	100.5	4.9

Common features of the seven cycles are summarized in the bottom section of the table, which provides averages of the variables for each phase over all seven cycles, with each phase weighted by its length. Columns (3) through (5) show that nominal GNP growth was highly volatile, with a 10.2 percent average growth rate during expansion phases and 2.6 percent rate during recession phases, for a difference of 7.6 percent. In contrast, M1 growth was much less volatile, with growth in expansion phases only 1.1 percent faster on average than in recession phases. As a result, fluctuations in monetary growth accounted on average for only 14 percent (1.1/7.6) of fluctuations in nominal GNP growth. The remaining 86 percent is accounted for by fluctuations in the growth rate of velocity.

Two objections may be raised to the contrast between the roles of money and velocity growth in business cycles. First, some commentators have pointed out that the permanent income theory of money demand implies a large elasticity of velocity movements to transitory monetary changes. Yet an inspection of the data reveals important episodes like 1967-68 or 1981-82 when money growth and velocity growth moved in opposite directions. The second and more legitimate objection is that the comparison in Table 1 neglects lags. Since this reservation is legitimate, in Table 4 we examine more sophisticated econometric evidence that takes account of lags in the impact of money on nominal GNP.

A prominent feature in Table 1 is the steady acceleration of monetary growth in successive business cycles beginning in 1961. The weighted average growth rates of money, velocity, and nominal GNP in successive cycles were (in percent):

	Money	Velocity	Nominal GNP
1958-61	1.9	3.3	5.2
1961-70	4.4	2.7	7.1
1970-75	6.2	3.1	9.3
1975-80	7.5	3.3	10.8
1980-82	6.1	1.5	7.6

Since velocity growth exhibited no significant change over these cycles, except for 1980-82, the behavior of money can be blamed for the long-term increase in nominal GNP growth and in the rate of inflation in the 1970s as compared to the 1950s and early 1960s. Thus a careful distinction must be made between the small role of money growth in contributing to the short-run timing of individual cycles, and its large role in contributing to overheating in the 1964-74 decade taken as a whole. This evaluation must be qualified to the extent that supply shocks contributed to the inflation of the 1970s. As pointed out later in this section, part of the acceleration of money growth in 1975-80 may have been a passive reaction to the 1973-74 supply shocks that forced the Fed to make an uncomfortable choice between lower output and higher inflation.

The behavior of the inflation rate in column (6) averaged over all cycles shows a striking countercyclical pattern, with an average growth rate of 3.8 percent in expansions and 5.2 percent in recessions. An examination of the individual cycles, however, suggests that the seven-cycle average mixes up three quite different types of experience. The recessions between 1949 and 1961, as well as the most recent 1980-82 episode, display the expected procyclical movement due to the role of the output ratio in equation (4). The middle three cycles between 1961 and 1980, however, exhibit a strong countercyclical pattern that helps to demonstrate the effect of the other two variables in that equation. One of its key implications, when joined with an adaptive type of expectation formation, is that there will be a continuous upward adjustment of the inflation rate when the output ratio remains above unity. This gradual adjustment of inflation was most obvious in the long 1961-70 cycle. Because inflation expectations adapted with substantial inertia to rapid nominal GNP growth, the economy experienced a period between 1964 and 1969 when the output ratio substantially exceeded 100 percent and the actual unemployment rate fell substantially below the natural rate of unemployment. The gradual upward adjustment of inflation continued into the 1969-70 recession, which witnessed faster inflation than previous phases despite slower nominal GNP growth. A complementary explanation is that the slowdown in nominal GNP growth in 1969-70 was the mildest of any of the postwar cycles, further inhibiting any deceleration of inflation.

Finally, the post-1970 period demonstrates the effect of the remaining variable in equation (4), the supply shock proxy. The 1970-75 and 1975-80 business cycles both ended with recessions that were triggered by supply shocks and amplified by a slowdown in nominal GNP growth. Between late 1972 and 1975 the relative price of oil increased by 25 percent, and again by more than 40 percent between late 1978 and late 1981. The relative price of food increased by about 10 percent between 1972 and 1974. Finally, the recession of 1973-75 was aggravated by the extra inflation that occurred after the termination in May 1974 of the Nixon-era price control program, and as a result of the 1971-73 devaluation of the dollar. As a result the inflation rate observed in the recession phase of these two cycles was substantially higher than in the expansion phase. The marked difference between the countercyclical behavior of inflation in the 1973-75 and 1980 recessions, and its procyclical behavior in the 1981-82 recession, provides a strong confirmation of the view that supply shocks matter and a refutation of those who focus narrowly on prior fluctuations in the growth rate of the money supply in explaining the inflation rate.

There was an additional consequence of supply shocks. Partly as a result of cost-of-living escalators in wage contracts, supply shocks had the effect of permanently raising the rate of inflation at any given output ratio. This forced policymakers to choose between prolonged recession and an acceleration in monetary growth to ratify the upward ratchet of information caused by the supply shock. During the 1975-78 expansion the choice was made to ratify the inflation rate. In this sense the postwar peak in the growth rates of money and nominal GNP during the 1975-80 cycle was not simply a perverse action by misinformed policymakers, but rather an indirect consequence of the supply shocks themselves. This is a primary example of the role of aggregate supply constraints as an influence on the conduct of monetary policy.

Lessons from the Postwar U. S. Experience

This brief review of postwar U. S. business cycles suggests two lessons that should guide the development of any new approach to dampening business cycles.

1. Because of inflation inertia, dampening cycles in real GNP growth requires dampening cycles in nominal GNP growth.

2. Policymakers may be tempted to move the economy below the natural rate of unemployment to generate jobs or above that rate to stop inflation, but in doing either they only breed future instability. By allowing the economy to remain so far below the natural unemployment rate between 1964 and 1969, policymakers of the 1960s indirectly created future business cycles by forcing the policymakers of the 1970s and 1980s to implement restrictive anti-inflationary demand management policies. By allowing the economy to remain so far above the natural unemployment rate in 1982-83, current policymakers are breeding future instability.

III. CHOICE OF THE OPTIMAL NOMINAL GNP GROWTH PATH

The choice of a nominal GNP growth target for domestic monetary policy, as opposed to the traditional monetary growth or interest rate targets, has several advantages. Like money, nominal GNP is a nominal variable and therefore an appropriate object of central bank concern. Like monetary growth, nominal GNP growth places a lid on the inflation rate and thus just as effectively avoids the disadvantages of nominal interest rate targeting to which Friedman (1968) called attention. A focus on nominal GNP growth rather than monetary growth centers the attention of the central bank on offsetting shifts in velocity growth, such as those which occurred in 1929-39 or 1981-83. In a world of velocity shifts both real output and inflation are more closely tied to nominal GNP growth than to monetary growth, and thus nominal GNP targeting allows the central bank to achieve more closely its ultimate goal variables. Since there are time lags between changes in the direct control instruments of central banks and subsequent effects on nominal GNP growth, it would be futile for central banks to attempt to offset every monthly or quarterly wiggle in velocity. Rather it is the historical fact that velocity exhibits serially correlated fluctuations of more than a year that justifies the concern with offsetting velocity movements over that longer term horizon.

Aggregate supply constraints make the choice of a nominal GNP growth path both difficult and fraught with long-term dynamic implications. Only if the economy is initially operating at its natural output level, the inflation rate is zero, and there are no supply shocks, can the choice be issue-free. Then nominal GNP growth is simply set to equal natural real GNP growth, which ratifies the current regime of stable prices, i.e., $y = q^N$. Ironically, the U. S. was actually in this situation at the end of 1963, just before the famous Kennedy-Johnson 1964 tax cut, which was subsequently accommodated by an acceleration in monetary growth. An important lesson is suggested by the subsequent five-year period of overheating with an output ratio above unity; economists were overly optimistic about the economy's sustainable output level in 1964 and they may be overly optimistic again. Only by evaluating and continuously updating the best available historical and statistical evidence can the central bank steer between the Scylla of overheating and the Charybdis of lost output. An additional lesson is that the central bank must act more cautiously when the economy is close to the estimated natural output level than when far below that level.

The next hypothetical situation to be considered is the same as in the preceding paragraph, with output equal to its natural level and supply shocks absent, but now the inflation rate is some positive number. If this inflation rate is generally agreed to be above the optimum inflation rate, the central bank faces the traditional tradeoff. A reduction of adjusted nominal GNP growth ($y - q^N$) below the rate of inflation will--in the presence of inflation inertia--lead to a temporary period of lower output and higher unemployment. Whether this sacrifice is worth making depends on (a) the social cost of lost output and employment, (b) the social benefit of lower inflation, (c) the social rate of time preference used to discount the permanent benefit of lower inflation, and (d) the component of the lost output taking the form of lost investment, which endows society with a semi-permanent loss that depends on the average lifetime of capital goods. This list of considerations is traditional. However, an extra non-traditional element is the problem of future cyclical instability and overshooting that results from a decision to push the economy away from its natural output level for the purposes of fighting inflation. A specific illustration of the problem is provided below from the U. S. initial conditions of early 1983. The problem is serious enough to warrant serious consideration of a policy that accepts ongoing inflation if the central bank finds itself lucky enough to be in an economy currently at the natural output level. Then the central bank would set its nominal GNP target at the inflation rate that seems currently imbedded in expectations (Eckstein's "core inflation rate," 1980) plus the growth rate of natural real GNP, that is, $y = p + q^N$. It may be more effective in the long run for the central bank to ratify an ongoing inflation and to lobby the legislature for reforms (like indexed bonds and financial deregulation) that reduce the costs of inflation, than to engage in a single-handed inflation-fighting restrictive policy.

The level of difficulty increases when the economy is exposed to adverse supply shocks, represented in equations (4) and (5) above by a positive realization of the "z" variable. This pushes up the inflation rate spontaneously without any required excess demand pressure and, if nominal GNP growth is maintained constant, requires a corresponding percentage decline in the output ratio. The advantage of nominal GNP targeting in the face of supply shocks is that it represents a compromise solution in between the extreme alternatives of targeting real output or inflation. To maintain constant real GNP would require monetary accommodation of any resulting inflation that occurred, which might be both substantial and permanent if there are (a) widespread cost-of-living escalators in wage and price contracts, and/or (b) a permanent decline in productivity and in natural real GNP resulting from the supply shock. To maintain constant inflation requires that the central bank reduce nominal GNP growth sufficiently to cause a recession that fully offsets the inflationary effect of the supply shock. In the simple context of equation (5), it can be shown that the output ratio ($\hat{Q}$) must be allowed to decline by z_t/b if any acceleration of inflation is to be avoided, and this recession may be substantial if b is a relatively small fraction.

Estimates of the Tradeoff Equation and the Natural Rate of Unemployment

If the economy is initially operating at a significant distance from the natural level of real GNP, then the central bank must have some view as to the current value of that variable. Recall that this is defined as the level of real GNP that is compatible with steady inflation in the absence of supply shocks. Its estimation requires fitting a regression equation in the general form of (4). My own work (1982a) proceeds by estimating (4) with quarterly U. S. data in the following specification which substitutes a demographically weighted unemployment rate (U_t^W) for the output ratio ($\hat{Q}_t$):

$$p_t = d_0 + a(L)p_{t-1} + b(L)U_t^W + c(L)z_t + e_t. \quad (6)$$

Here the estimated coefficients written in the form a(L) are one-sided polynomials in the lag operator, and e_t is an error term. A distributed lag on past actual inflation is used as a proxy for the expected rate of inflation that appears in (4). Conveniently the estimated a_i coefficients on the lagged inflation terms sum to unity over the 1954-80 sample period, and so the estimated version of (6) embodies the natural rate hypothesis. Extensive tests reject the hypothesis that the constant term d_0 or the unemployment coefficients (b_i) have shifted over the 1954-80 period, and so the estimates imply that the "no shock" natural weighted unemployment rate is equal to $-d_0/\Sigma b_i$. The natural unemployment rate for the official unweighted concept has gradually shifted upward relative to the constant natural weighted unemployment rate due to demographic shifts; values for the official natural rate concept climb gradually from 5 percent before 1963 to 6 percent after 1975.[6] Natural real GNP is then set equal to actual real GNP in periods when actual unemployment was at the natural rate, and interpolated in between. This yields the output ratio series shown in Table 1.

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[6]The natural unemployment rate has risen far more in some other countries. The German evidence is assessed in this framework in Franz (1983).

The central bank cannot accept such an estimate of the natural unemployment rate as carved in stone. In addition to estimation errors, unidentified factors can cause the natural rate to shift over time. Thus an important step in planning future monetary policy must be to monitor recent errors in the forecasting ability of an equation like (6). To allow such monitoring, I have been careful not to reestimate (6) since early 1981. To test whether errors have been systematic and significant since the end of the sample period in 1980, the estimated version of (6) can be used to forecast the inflation rate for 1981 and 1982, using actual values of the independent variables but generating its own values, quarter-by-quarter, for the lagged inflation rate terms. The result is the following forecasting record:

	Four quarters of 1981	Four quarters of 1982	Eight quarters of 1981-82
Actual inflation rate	8.5	4.9	6.7
Predicted inflation rate	7.5	5.1	6.3
Error (actual - predicted)	1.0	-0.2	0.4

Thus the actual inflation rate has turned out to be slightly higher than predicted, indicating that, thus far in the prediction period, my 6.0 percent estimate for the natural unemployment rate may be a bit too optimistic. This prediction record also has another important implication, that the relatively rapid deceleration of inflation observed in 1982 is not "surprising" and does not suggest any important shift in the economy toward greater price flexibility as compared to the 1954-80 period. There is no evidence that there has been any "rational expectations" or "credibility" effect that caused inflation to decelerate faster than predicted by the inertia-prone history of 1954-80.

While the evidence suggests that the "no shock" natural unemployment rate might be 6.5 rather than 6.0 percent, the band of uncertainty surrounding this question is more important for policymaking in future years than it is in 1983, with an unemployment rate around 10 percent. Another mitigating factor that somewht eases the Fed's task is the inertia of the inflation process itself. If policy errors do cause unemployment to slip half a point below the natural rate for six months or a year, no great disaster will occur. Five years with unemployment two percentage points below the natural rate in the 1960s were required to generate an acceleration of inflation from 1.5 percent in 1964 to 5 percent in 1969. More modest errors will have more modest consequences.

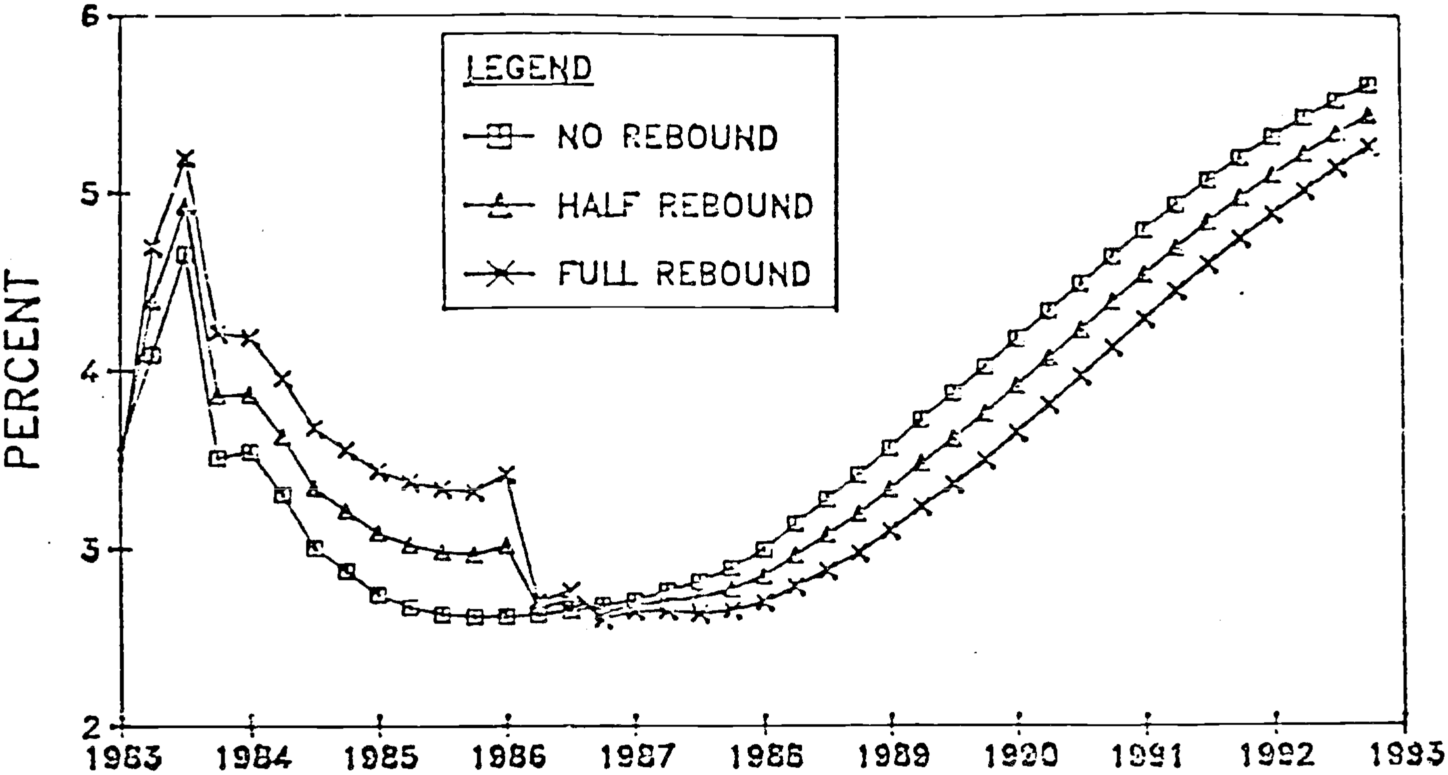
An Illustration of Alternative Nominal GNP Paths

The difficulties of managing the economy when the initial unemployment rate is far away from the natural rate can be likened to the problem of a pilot in bringing an airplane in for a smooth landing on a runway. Here altitude corresponds to the unemployment rate, and the runway corresponds to the natural unemployment rate. The problem is to avoid crashing into the runway. The worst thing the Fed can do is choose a constant growth rate of nominal GNP and stick to it, for this guarantees a crash.[7]

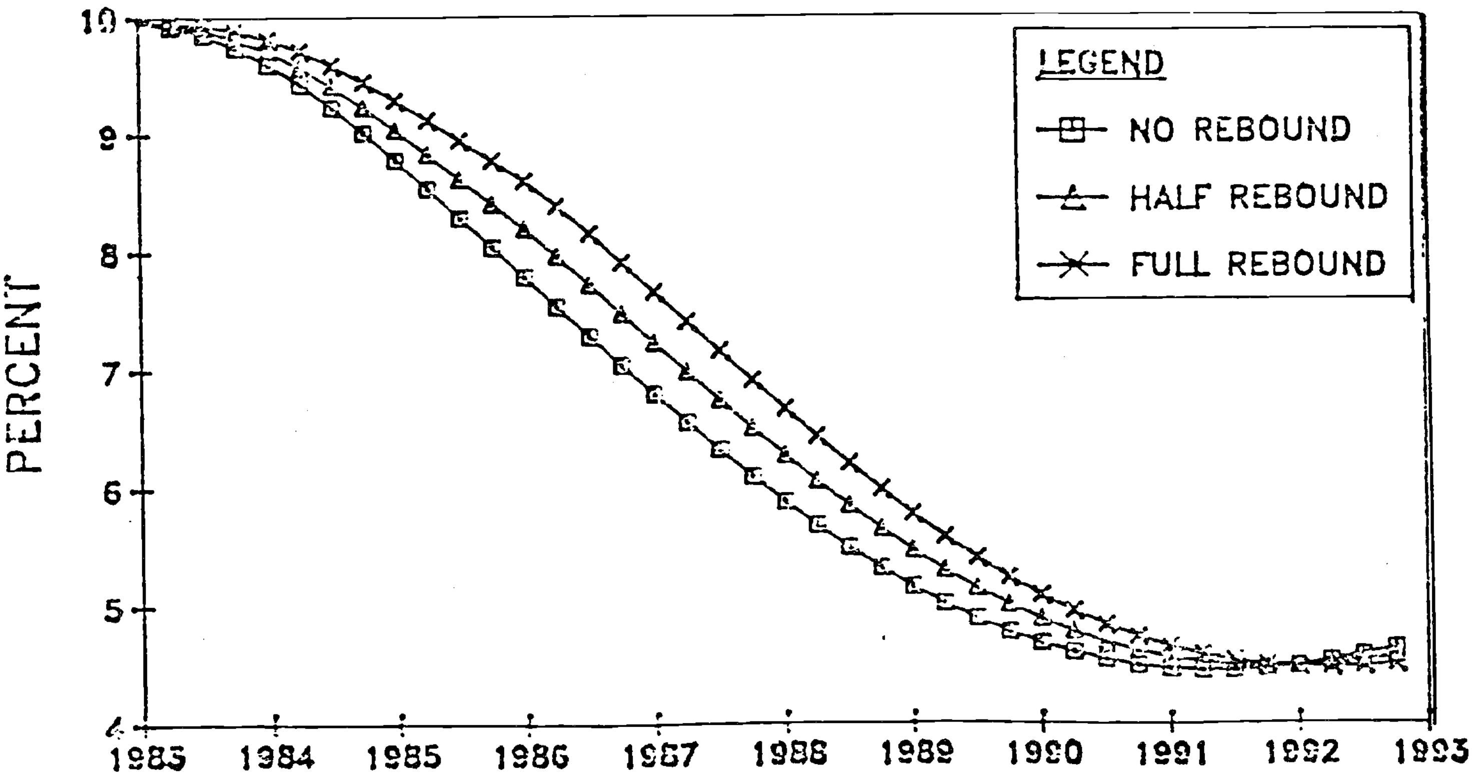
This point is illustrated in Figure 1, which shows what happens beginning in early 1983 in a simulation with my econometric inflation equation (6) when the growth rate of nominal GNP is set at 8 percent forever. The economy's recovery is slow, inflation continues to

[7] Poole (1982, p. 592) in contrast recommends a monetary airplane which requires no "pilot expertise" and instead runs in an "autopilot" or "hands off" mode.

FIGURE 1



INFLATION RATE



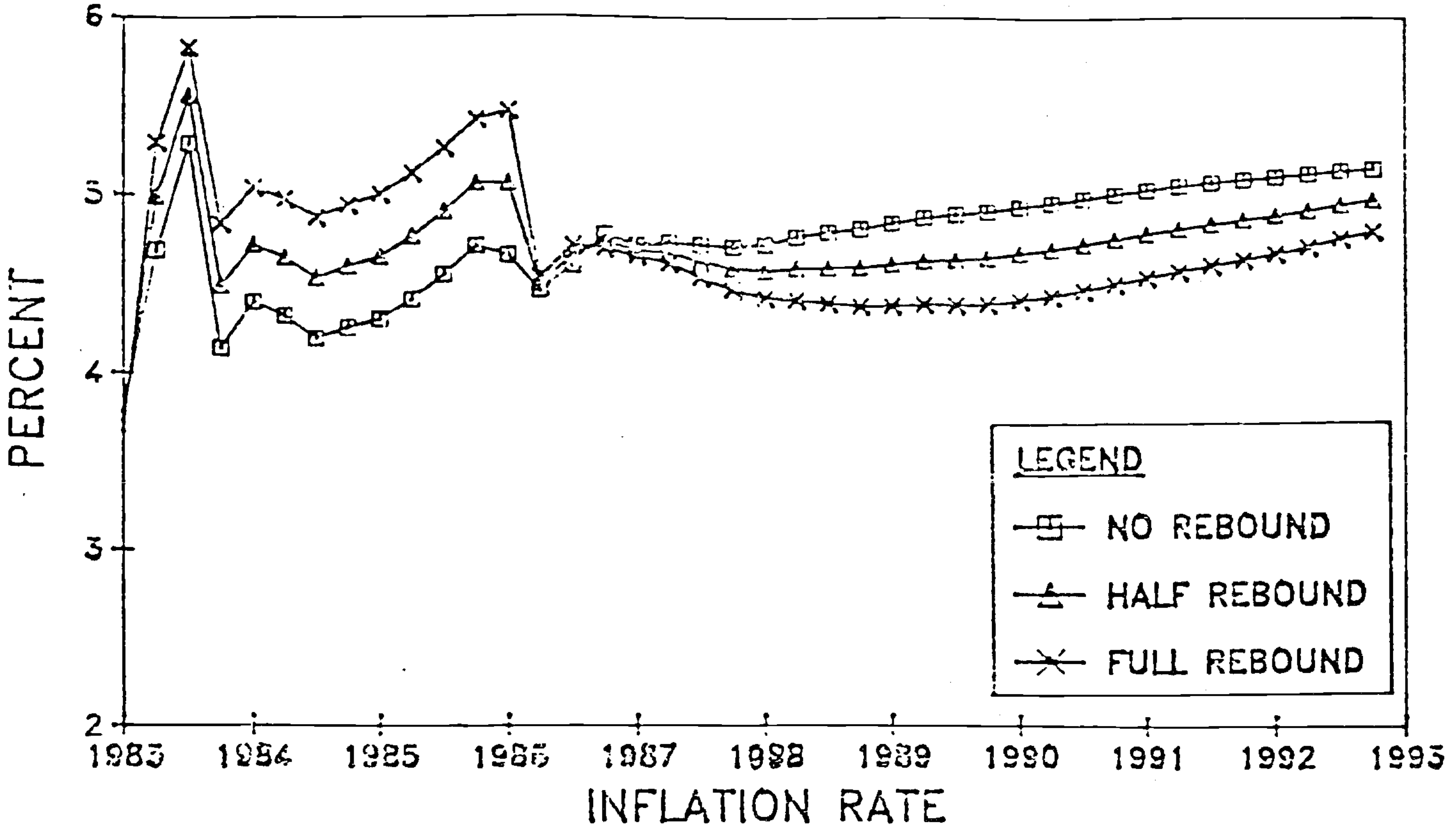
UNEMPLOYMENT RATE

decelerate in response to economic slack, and by definition real GNP growth speeds up. It is as if the pilot had pointed the plane's nose toward the runway and then had turned on the engines full throttle. The lower frame of Figure 1 shows how the economy crashes through the assumed 6 percent natural rate of unemployment in the period 1987-88, and the upper frame shows how a companion airplane, the inflation rate, takes off at the same time.

The Fed's task is tougher than the pilot's, because there is no chart that shows the exact altitude of the runway. The band of possible outcomes in Figure 1 exhibits only one of the possible sources of uncertainty, the likely future behavior of the main supply shock variables (the relative prices of imports, food, and energy, as well as the exchange rate). The pessimistic path assumes a "full rebound," that all of those variables return to their values at the end of 1980 (i.e., that the value of the dollar falls by about one-third in 1983-85 and that the nominal price of oil rises to about $40 per barrel). The optimistic path assumes "no rebound" in these variables, and that they remain at their values of late 1982.

The maneuver necessary for the pilot to make a soft landing is illustrated in Figure 2. Here the growth rate of nominal GNP starts out at 10.5 percent, but in late 1985 is slowed suddenly to 8 percent. With either the optimistic or pessimistic assumption about supply shocks, the unemployment rate glides smoothly in to the assumed 6 percent natural rate of unemployment. And, as shown in the top frame, the inflation rate (p) smoothly adjusts to the long run 5 percent rate that is compatible with an 8 percent nominal GNP growth rate (y) and a 3 percent growth rate of natural real GNP (q^N), since in the long run $p = y - q^N$.

FIGURE 2


PERCENT
6
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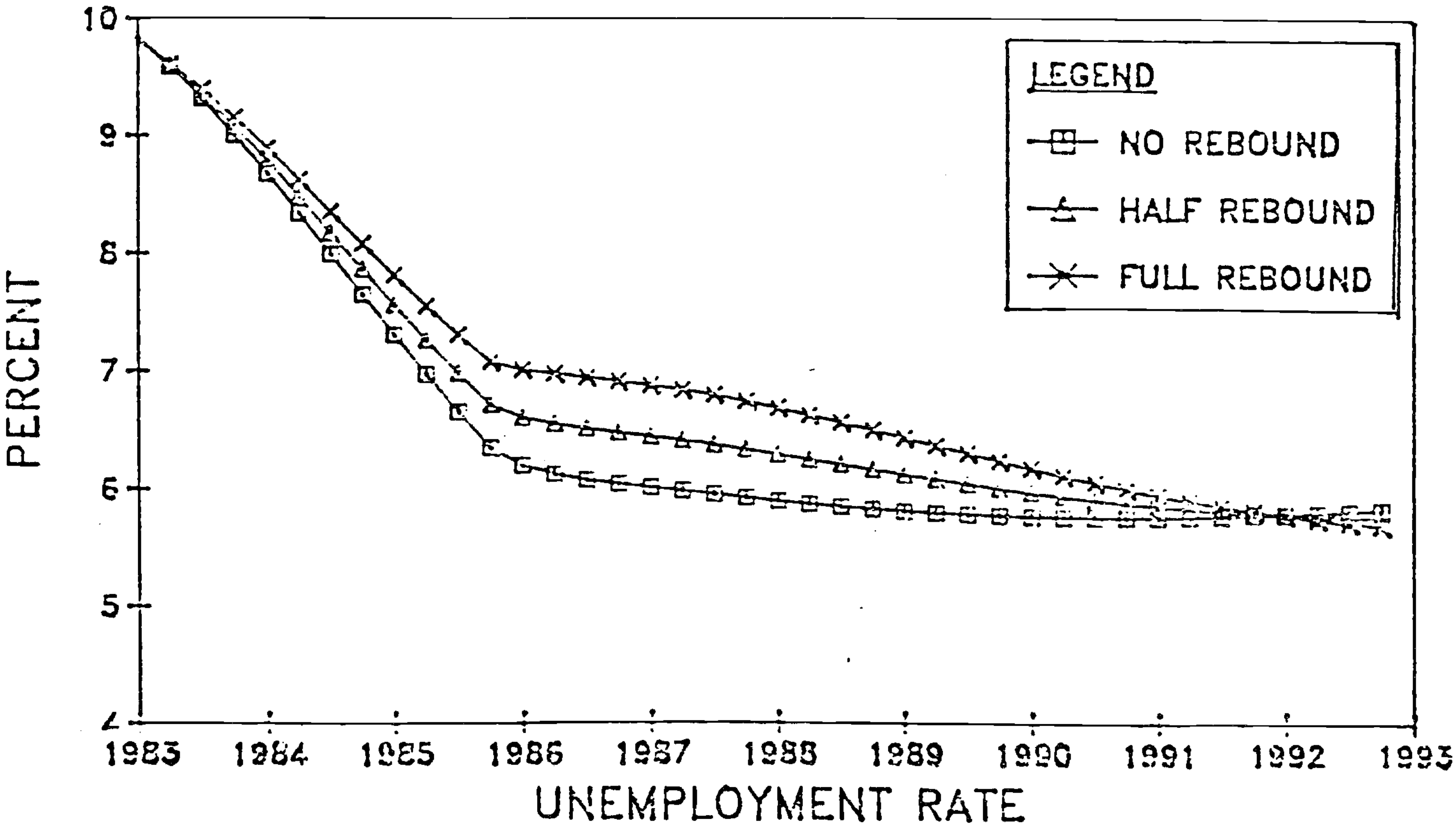
INFLATION RATE
LEGEND
NO REBOUND
HALF REBOUND
FULL REBOUND


PERCENT
10
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1983
1984
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1991
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1993
UNEMPLOYMENT RATE
LEGEND
NO REBOUND
HALF REBOUND
FULL REBOUND

The Fed must decelerate the growth rate of nominal GNP when the economy nears its natural rate of unemployment. That is the prerequisite for a soft landing. But a likely side effect of any attempt to achieve a sudden slowing of nominal GNP growth is a sharp increase in interest rates, and perhaps a recession during the transition period. To minimize the danger of inducing this type of instability, the Fed should plan to induce a rapid recovery when the economy is far from the natural rate and gradually to taper the growth rate of nominal GNP from then on. There is no compelling alternative. Rapid nominal GNP growth maintained forever guarantees a crash landing. But even moderate nominal GNP growth maintained forever eventually leads to a crash landing, as shown in Figure 1.

IV. MANAGING MONETARY POLICY IN THE FACE OF UNSTABLE VELOCITY GROWTH

To this point most of the emphasis in this paper has been on the influence of aggregate supply constraints on the choice of target paths for nominal GNP growth. Figures 1 and 2 of the preceding section showed that stable long-run growth of output without recurring oscillations requires a nominal GNP path which is not constant but rather decelerates as the economy nears its natural rate of unemployment. If the rate of growth of M1 velocity were constant, then a policy of decelerating M1 growth at the desired pace of nominal GNP deceleration would be adequate. If, in turn, the "money multiplier" (M1/monetary base) were constant, then a policy of decelerating the growth rate of the monetary base would be adequate. The latter policy has recently been recommended by prominent U. S. monetarists, including Milton Friedman, Karl Brunner, Allan Meltzer, and William Poole.[8]

However, neither of the two required preconditions for targeting the monetary base, constant growth in M1 velocity and in the money multiplier, actually exists. M1 is flawed as a monetary target not only because M1 velocity has been unstable and unpredictable, but also because of multiplier instability. In this verdict we follow Bryant (1982, p. 599), who concludes that "...the money stock cannot be an instrument of monetary policy: the Federal Reserve cannot control it precisely from one short-run period to the next." And growth in the base is flawed as a target for the same reason, because instability in velocity and the multiplier allows wide fluctuations in nominal GNP growth to occur even in periods (like 1971-79) when base growth was remarkably stable.

While the instability of velocity growth does create a significant problem for monetary policy, it is important to avoid exaggerating the nature of the difficulty. Some short-term fluctuations of velocity growth are not only inevitable but impossible to forecast. The best forecasters have consistently missed the timing of cyclical peaks and troughs connected with inventory accumulation and decumulation. To avoid undue attention to nominal GNP changes caused by the short-term inventory cycle, from this point on we exclude inventory changes from the concept of nominal GNP. In the U. S. national accounting language, GNP less inventory change is called "final sales."

[8]See Friedman (1983a), Brunner (1981), Meltzer (1981), and Shadow Open Market Committee (1983). Poole (1982, p. 593) recommends a policy of "really stable growth in the nonborrowed monetary base."

The Historical Behavior of Final Sales, Velocity and the Money Multiplier

Table 2 summarizes the historical U. S. behavior of the growth of nominal final sales, key monetary concepts, and the level of short-term interest rates over the period between 1953 and 1982. Four sub-periods are chosen, with the first three divided into equal nine-year intervals through 1979, and the last sub-period chosen to begin in October 1979 at the time of the much-heralded change in Federal Reserve operating procedures. Section A of the table exhibits average percentage growth rates for nominal final sales and the monetary concepts and average percentage levels for the nominal and real Treasury bill rate.[9]

The most striking aspect of section A is the common acceleration of all nominal growth rates in the first three sub-periods, including nominal final sales, the monetary base, and M1. The nominal Treasury bill rate also increases over the same interval. Average growth in velocity was relatively stable over the first three sub-periods, while growth in the money multiplier shifted from a small positive to a small negative number in the early 1960s. Notable features of the last sub-period beginning in 1979:Q4 include the pronounced drop in velocity growth, and the sharp increase in both the nominal and real Treasury bill rate. There was almost no deceleration in M1 or base growth as compared to the 1971-79 average rate.

Section B of the table exhibits standard deviations of the same variables, calculated alternatively as one-quarter changes and

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[9]The real interest rate is calculated as the nominal interest rate minus an eight-quarter moving average of the quarterly change in the personal consumption deflator.

TABLE 2

Means and Standard Deviations of
Growth Rates of Nominal Final Sales and Monetary Variables,
and the Level of the Nominal and Real Treasury Bill Rate,
Selected Sample Periods

	1953:Q1 -1961:Q4	1962:Q1 -1970:Q4	1971:Q1 -1979:Q3	1979:Q3 -1982:Q4
A. Means				
1. Nominal Final Sales	4.6	7.0	10.1	8.3
2. Monetary Base	1.3	5.3	7.6	7.2
3. M1 Multiplier	0.4	-1.0	-1.0	-0.6
4. M1	1.7	4.3	6.6	6.0
5. Velocity (NFS/M1)	2.9	2.7	3.5	1.6
6. Nominal Treasury Bill Rate	2.3	4.6	6.1	12.1
7. Real Treasury Bill Rate	0.3	1.8	-0.1	3.8
B. Standard Deviations (one-quarter/four-quarter)				
1. Nominal Final Sales	3.6/2.3	2.2/1/6	3.0/2.0	4.9/3.0
2. Monetary Base	1.4/0.9	1.4/0.9	1.8/0.9	2.7/1.3
3. M1 Multiplier	2.0/1.3	1.7/0.9	2.1/1.2	4.3/1.7
4. M1	2.0/1.4	2.3/1.6	2.0/1.3	4.7/1.5
5. Velocity (NFS/M1)	3.2/2.1	2.7/1.3	2.9/1.3	5.1/2.1
6. Nominal Treasury Bill Rate	0.9	1.4	1.7	2.1
7. Real Treasury Bill Rate	0.9	0.5	2.0	1.7

four-quarter overlapping changes. The latter measure smooths out quarter-to-quarter noise in the data that the central bank can do little to control and which have little effect on economic well-being. The first three sub-periods exhibit few interesting signs of change. The standard deviation of both nominal final sales growth and velocity growth declined from the 1950s to the 1960s and 1970s. The variables showing the least variance were the growth rate of the monetary base, particularly by the four-quarter-change criterion, as well as the two interest rate series. There was a substantial increase in the variance of interest rates, both nominal and real, from the first to the third sub-period.

The relatively stable behavior of growth in the monetary base requires more attention and comment, because growth in the base has been frequently suggested as the central operating target for monetary policy. The historical record suggests that the Fed has in fact maintained quite steady growth in the monetary base over long periods without preventing continuous large fluctuations in the growth of nominal final sales. For instance, between 1954 and 1961 the four-quarter rate of change of the monetary base never fell below 0.1 percent nor rose above 2.2 percent in any single quarter. The same narrow range was maintained between 1971 and 1979, when four-quarter base growth never fell below 6.6 percent nor rose above 8.9 percent. Yet despite this steady pace of base growth, four-quarter nominal final sales growth varied widely, from -0.3 to 7.8 percent between 1954 and 1961, and from 6.8 to 14.3 percent between 1971 and 1979. And, as Paulus (1982, p. 632) points out, "...even though base growth has been essentially trendless over the decade, the core inflation rate moved from around 5 percent in the early seventies to almost 10 percent at the end of 1980." This examination of the historical record suggests that in fact past changes in the monetary base seem to have had little relation to changes in nominal final sales, except during the 1960s, when the economy made its transition from low to high growth rates of all nominal variables.

Much attention has been directed to the increased variance of monetary magnitudes after the change in Federal Reserve operating procedures in October, 1979. Monetarists have claimed that the Federal Reserve did not, as often claimed, shift to "monetarist" operating procedures, because this would have required reducing the variance of monetary growth and increasing the variance of interest rates. Their claim seems validated in section B of Table 2, which shows that there was no important change in the variance of interest rates (either nominal or real) after 1979:Q3 as compared to 1971-79, but a huge increase in the standard deviation of one-quarter changes in the monetary base and in M1.[10] Changes in nominal final sales and in velocity also exhibit substantial increases in variance.

But it is also clear from the table that the monetarist claim results almost entirely from high-frequency quarter-to-quarter movements. The standard deviation of four-quarter changes in M1 after 1979 was virtually the same as before 1979. There were larger increases in the standard deviation of four-quarter changes in the base and multiplier, but these must have been offsetting since they did not make M1

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[10]B. Friedman (1982) shows, however, that there was a marked increase in the variance of long-term interest rates after 1979.

more variable. The biggest shift after 1979 was actually in the standard deviation of nominal final sales and velocity changes. This implies that much of the instability in the economy after 1979 was due more to shifts in expenditure and money demand behavior than to instability created by the Fed's control of M1.[11]

Contribution of Monetary Variables to the Explanation of Nominal Final Sales Growth

Thus far this paper has contained two pieces of evidence that fluctuations in the growth rate of M1 or of the monetary base have not contributed much to the explanation of business cycles in nominal final sales growth (which in turn, due to inflation inertia, have caused business cycles in real output and employment). The first was the observation based on Table 1 that variations in M1 growth between expansion and recession phases of the business cycle accounted for only 14 percent of variations in nominal GNP growth, and velocity accounted for the remaining 86 percent. The second was the observation based on Table 2 that smoothness of base growth in the 1950s and 1970s relative to nominal final sales growth suggested a small causal role for the base in business cycles. This section examines these assertions more systematically.

Granger (1969) and Sims (1972) have popularized statistical tests to determine relations of exogeneity or temporal independence among time-series variables. One popular test is to regress a variable of interest, in our case quarterly changes in nominal final sales, on its

[11]In fact Poole (1982) argues that the Fed did not change its operating procedures after 1979 in a fundamental way.

own lagged values and lagged values of another variable of interest, e.g., changes in M1 or in the monetary base. The significance of the contribution of the monetary variable can be determined through the use of a F test that compares the complete equation with an alternative that excludes the monetary variable (and thus includes only the lagged dependent variable and a constant term). A more general form of the test is to include several lagged monetary variables and test for their significance either individually or as a group.

Tables 3 and 4 carry out such tests for the first three sub-sample periods studied in Table 2. The period after October, 1979, is excluded, because there are not enough available observations for the test procedures to be used. Before we turn to measures of statistical significance in Table 4, we calculate in Table 3 the change in the percentage of nominal final sales growth variance that is explained when alternative monetary variables are added to equations already containing the lagged dependent variable. In all cases the lagged dependent variable and the alternative monetary variables are included as four lagged one-quarter changes.

The first line in Table 3 shows that serial correlation in the quarterly growth rate of nominal final sales explains about one-quarter of its variance in the 1950s and 1960s, but virtually nothing in the 1970s. Line 2a shows that the addition of lagged changes in M1 to an equation already containing the lagged dependent variable explains 9 percent of the variation in the 1950s, 22 percent in the 1960s, and 31 percent in the 1970s. This compares to the contribution of 14 percent on average over cycle phases calculated above in Table 1. The next two lines contain an interesting result. Changes in the base contributed to explaining the variance of nominal final sales changes only in the 1960s, with virtually no contribution in the 1950s and 1970s. Almost

TABLE 3

Contribution of Alternative Monetary Variables
to the Explanation of Quarterly Changes in
Nominal Final Sales,
Selected Sample Periods

	1953:Q1 -1961:Q4	1962:Q1 -1970:Q4	1971:Q1 -1979:Q3
Percentage reduction in unexplained variance contributed by addition of four lagged values of:			
1. Nominal final sales	23.8	24.8	1.0
2. Alternative Monetary Variables			
a. M1 changes (M1)	8.9	21.9	30.7
b. Base changes (MB)	5.6	18.6	3.5
c. Multiplier changes (MM)	6.6	17.8	28.5
d. Treasury bill rate (i)	5.7	10.6	1.2
3. Combinations of Monetary Variables			
a. M1, i	10.9	25.7	34.1
b. MB, i	12.4	23.8	4.0
c. MM, i	9.2	22.3	31.0
d. MB, MM, i	26.3	34.8	48.3

all of the contribution of M1 in the 1970s (line 2a) can be traced to the behavior of the multiplier (line 2c). The small explanatory role of base growth in the 1950s and 1970s confirms the point made in the previous section that the Federal Reserve has really already experimented with maintenance of steady base growth without any success in dampening the cyle.

Line 2d indicates that the addition of the nominal Treasury bill rate by itself contributes little to the explanation of sales changes. Section 3 adds monetary variables in several combinations and confirms the results of section 2. The addition of the interest rate on lines 3a through 3c adds little to the corresponding contributions on lines 2a through 2c. The greatest contribution of the monetary variables is made when the base, multiplier, and interest rate are included together. The fact that the contribution on line 3d is greater than on line 3a suggests that the base and multiplier components of M1 contribute to the explanation of sales growth with different coefficients, and so they are treated as separate variables.

Corresponding to this conclusion, Table 4 exhibits the significance of each of four variables (changes in sales, the base, the multiplier, and the level of the nominal interest rate) in contributing to the explanation of each other's variance in the same sub-periods. The four variables are estimated as a symmetric vector autoregressive model, with four lagged values of each variable entering each equation. The table lists significance levels rather than F ratios, and the variables that are significant at the level of 10 percent or better are indicated by an asterisk.

Perhaps the most striking fact about Table 4 is simply that there are very few asterisks. Another interesting result is that the three

TABLE 4

Significance Level of Contributions of
Quarterly Changes of the Monetary Base,
the M1 Multiplier, and Nominal Final Sales,
and of the Level of Nominal Treasury Bills Rate
Selected Sample Periods

To Explanation of	Significance Level of Contribution of Base	Multiplier	T.B. Rate	NFS
		(1)	(2)	(3)(4)
Base				
1953-61	.94	.17	.29	.02*
1962-70	.95	.16	.92	.19
1971-79	.44	.13	.11	.15
Multiplier				
1953-61	.94	.70	.75	.74
1962-70	.36	.21	.06*	.69
1971-79	.77	.95	.08*	.49
T.B. Rate				
1953-61	.42	.57	.00*	.92
1962-70	.13	.03*	.46	.46
1971-79	.17	.29	.00*	.13
NFS				
1953-61	.61	.40	.08*	.30
1962-70	.64	.44	.48	.11
1971-79	.17	.04*	.73	.18

periods appear to exhibit quite different significance levels. Starting at the top of the table, the only variable making a significant contribution to growth in the monetary base is growth in NFS for the first period. This may imply that the Federal Reserve was sufficiently concerned about stabilizing interest rates as to allow changes in the monetary base to respond to prior changes in NFS. In the 1970s the base was influenced at close-to-significance levels by all three other variables, the multiplier, the interest rate, and NFS. In the middle period the base appears to have been completely exogenous and thus a plausible candidate as the prime initiator of accelerating inflation. This response of the base may not actually have been exogenous, but rather an accommodation of fiscal deficits (not included in the table) caused by the Kennedy-Johnson tax cuts and by Vietnam war spending.

Although the multiplier appears to have been exogenous in the 1950s, after 1961 its behavior reflects a significant influence of the Treasury bill rate. This may suggest a channel of causation by which changes in the interest rate alter portfolios, in turn shifting average reserve requirements and thus influencing the multiplier. The Treasury bill rate seems to have been influenced mainly by its own past values, but also by the multiplier in the 1960s. This interaction between the interest rate and the multiplier in the 1960s requires additional research to sort out the underlying causes.

The last section of the table comes to the variable of central interest, changes in NFS. Column (1) confirms the conclusions of the previous section that there was no significant causal role for the monetary base in the 1950s and 1970s. A new conclusion is that there was also no significant explanatory role for the base in the 1960s. This result seems hard to reconcile with the idea that acceleration in all nominal growth rates between the early and late 1960s was the source of the inflation of the 1970s. It is interesting to note, in fact, that in the 1960s the significance level of feedback from sales to the base (0.19) is greater than from the base to sales (0.64).

The only monetary variables having significant explanatory power for sales growth are the Treasury bill rate in the 1950s and the multiplier in the 1970s. Since multiplier movements in the 1970s are significantly related to the Treasury bill rate, it thus appears that the latter plays a direct or indirect role in explaining sales growth in both the 1950s and 1970s. Sales growth seems to live a life of its own in the 1960s, perhaps because of the omission of indicators of fiscal policy.

The results of this analysis differ substantially from a similar investigation carried out by Cagan (1982). Cagan's equations are in the same "Granger" format as Table 4, with the lagged dependent variable included (two lags for Cagan, four in Table 4), but differ by including only one monetary variable at a time (and by explaining changes in nominal GNP rather than NFS). His results differ across two sample periods, 1953-67 and 1968-80. In the earlier period he finds that the checkable deposits component of M1 is the only monetary variable that contains significant "advance information" about GNP movements, in the sense that the addition of five lagged changes in deposits adds to the fit at a high significance level. In the latter period M2 displays information not contained in checkable deposits or the monetary base. Cagan speculates that substitutions among M2 components have become larger, "reflecting no doubt the increase in level and variability of interest rates" (p. 683). In both periods, there is no significant advance information in the monetary base, reflecting what appears to be a contemporaneous correlation between GNP and currency demand, thus confirming our finding that the base contains no predictive power for NFS changes.

Cagan's finding the M1 contains advance information before 1968 and M2 after 1968 does not contradict our view that neither monetary aggregate is an appropriate operating target. Our tests, which split M1 between the base and multiplier changes, and which include as well the level of the short-term interest rate, indicate that the main explanatory power of money comes from multiplier shifts that are associated with changes in the interest rate. These imply that control of base growth will not prevent fluctuations in the growth rate of monetary aggregates and NFS, and they also imply that portfolio shifts make M1 unsuitable as an operating target. Although this paper does not test M2 explicitly, recent shifts in M2 velocity also appear to render it unsuitable for monetary targeting (See Kopcke, 1983, and Tatom, 1983).

Implications of the Statistical Analysis

The most important conclusion is that changes in the monetary base appear to play no significant causal role in explaining changes in nominal final sales during the 1953-79 period. Although estimated in a very different format, these results thus seem to confirm the negative results of Sims (1980) regarding the causal role of money. Unlike Sims', our conclusion is not dependent on the inclusion of the interest rate. And also a different emphasis here is in the lack of causal influence of base changes; multiplier changes seem to play a significant role, at least in the 1971-79 sub-period. The major difference in the roles of the base and multiplier confirms the results of a seminal recent paper by Stephen King (1983), who deserves credit for directing my attention to the behavior of the two components of M1 growth. It also confirms the emphasis placed by Fellner (1982) and Bryant (1982) on multiplier instability as a major source of changes in M1.[12]

V. IMPLEMENTING A NOMINAL FINAL SALES TARGET

The literature on domestic monetary policy can be viewed as drifting over a long period toward the conclusion that nominal spending should be the central medium-term target of the Federal Reserve Board. This conclusion has been reached by a "lesser of evils" process in which alternatives have been gradually omitted from consideration. First, Friedman (1968) demolished the case for targeting nominal interest rates by showing that this requires the central bank to accommodate any upward shift in spending or downward shift in the demand for money, as well as any subsequent upward pressure on the nominal interest rate coming from an upward adjustment in the expected rate of inflation. Some interest rate partisans have retreated from targeting the nominal rate to the real rate. Real interest rates are hard to target because they are not observable. Further a real interest rate target leads to procyclical monetary fluctuations, as demonstrated in undergraduate macro texts. And it has the additional perverse effect of requiring the Fed to institute a restrictive monetary policy in response to adverse supply shocks. For instance, in 1974 the Treasury bill rate increased from 7.0

[12]Fellner (1982) attributes most of the variance in the multiplier to shifts in the currency-deposit ratio.

to 7.9 percent while the inflation rate in the GNP deflator soared from 5.8 percent to 8.8 percent, reducing the real interest rate from 1.2 to -0.9 percent. A policy of stabilizing the real interest rate would have required the Fed to boost the nominal Treasury bill rate by two percentage points more than actually occurred, which in turn would have required that, instead of merely bringing M1 growth to a halt between April and October, 1974, the Fed would have been required to achieve substantially negative M1 growth.

The only advantage of real interest rate targeting, as pointed out by William Poole (1970), is in a situation when the demand for money is much more unstable than the demand for commodities. The period between early 1981 and mid 1983 in the U. S., with unparalleled movements in velocity as financial deregulation caused portfolio shifts, is a good example of a situation when the Poole analysis would call for interest rate stabilization. But Poole reaches his conclusion in a theoretical model with fixed prices where the ultimate criterion is stabilization of real GNP, and with fixed prices this criterion is equivalent to stabilizing nominal GNP. Thus, even in a period of portfolio shifts and unstable money demand, a nominal GNP or sales growth criterion can do as well as a real interest rate criterion, without the disadvantages of (a) the need to identify whether or not money demand is unstable, (b) an undesirable tendency toward monetary accommodation in response to increases in commodity demand, and (c) procyclical movements in monetary growth that amplify the real output changes caused by supply shocks.

The new element contained in this paper, building on and confirming the work of Sims and King, is that neither M1 nor the monetary base is a viable target for the central bank. Any causative role for M1 or the base is limited to the period of the 1960s, when all nominal variables accelerated together. The significance tests of Table 4 find no evidence that the acceleration of the base was temporally prior to that in final sales. The only important role of M1 comes in the 1970s due to changes in the multiplier, not the base, and the Fed does not control the multiplier directly. In short, the famous monetarist recommendation of maintaining steady growth in either the monetary base or in M1 has little potential as a remedy for business cycles. Because targeting interest rates must be ruled out as well, nominal GNP or sales emerges as the least objectionable target.[13]

Length of Horizon

Since 1979 the Federal Reserve has adopted the practice of targeting on "M1 growth cones," that is, ranges of the level of M1 that begin at a single point at the end of one year and then extend out to cover a considerable range by the end of the next year. The defect of this procedure is that each year is considered one at a time, and no effort is made to correct for drift. Thus, if the range for year "1" were 4 to 8 percent, with a desired mean of 6, and if the actual outcome by the end of year 1 were a growth rate of 9 percent, then the growth cone for year 2 would begin 3 points (9-6) over the previous target.

This type of drift could be avoided by planning ahead over a longer

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[13]A detailed consideration of other broader monetary aggregates, or a credit target, is outside the scope of this paper. Targeting credit has all the disadvantages of targeting nominal sales without any of the advantages. Both credit and NFS are distant from the Fed's control instruments, but nominal final sales is a variable of central policy concern while no one cares directly about the level or growth rate of total credit.

horizon, e.g., ten years as in Figures 1 and 2. The desired path for growth rates over the next decade is then translated into a desired path for the level of nominal final sales. Thus any situation when the level of NFS exceeds the target path would call for monetary restriction, whether it occurs in the spring or the fall, and whether it occurs this year or three years from now. There would be no jump to a new "growth cone" at an arbitrary date.

The entire growth path would be contingent on a continually updated estimate of the economy's ultimate long-run target, the natural rate of unemployment. If an inflation equation like (6) above were to begin underpredicting the rate of inflation, this would imply that the natural rate of unemployment had begun to drift up, and that a lower NFS target path would be appropriate. The reverse could occur as well. But the crucial distinction here is that the path would not be revised in light of "misses" in tracking the desired path during a particular year, but only if there is new information that the entire path should be revised from beginning to end. I share Fellner's belief (1982, p. 642) that the central bank should exhibit a "high degree of reluctance" to change the NFS path, once it is set.

There is an overlap between this paper and those of Fellner (1982) and Meltzer (1981). They would set a target for the average growth in nominal GNP over an entire business cycle but would not try to smooth nominal GNP growth fluctuations within the business cycle. Instead, Meltzer would calculate the desired trend path of the monetary base from historical trends in the multiplier and velocity and require the Fed to maintain constant base growth as its prime objective. Fellner emphasizes the defects of base control, due to the instability of the M1 multiplier, and prefers M1 as the operating objective (thus requiring movements in the base to offset movements in the multiplier). The discussion in this paper starts from the same place, the choice of a path for nominal GNP (or NFS) over the business cycle, but pays attention to the behavior of NFS growth within the cycle as well, on the grounds that historical trends in velocity have become a poor guide to the path of M1 required to achieve stable NFS growth.

The Use of Forecasts

Since quarterly changes in NFS tend to be erratic, a more appropriate focus for the central bank would be changes in a longer-term moving average, say four-quarter rates of change. This leads to the problem that there are lags between changes in the control instruments of the central bank and the reaction of NFS growth. One possible solution would be to target forecasts for NFS growth over the subsequent four quarters. Imagine that the desired growth path for the U. S. in 1983 is 10.5 percent, as assumed in Figure 2. As of July, 1983, the "central tendency" in the forecasts of Federal Open Market Committee members was for nominal GNP growth of 9.9 percent for 1982:Q4 to 1983:Q4, and 9.5 percent for 1983:Q4 to 1984:Q4.[14] In response to these forecasts, the Fed would have reacted by gradually allowing short-term interest rates to drift lower. It would have ignored rapid observed growth rates in the monetary base and in M1. It might also have encouraged a depreciation in the exchange rate, since the high value of

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[14]See U. S. Federal Reserve Board (1983), p. 5.

the dollar appears to have been partly responsible for the slump in velocity growth since mid-1981.

The implication that in 1983 the Fed would have paid attention to interest rates in the short run and ignored base growth reflects both Poole's (1970) conclusion and the results of Table 4. When the demand for money is unstable, then controlling interest rates makes more sense than controlling the base. Further, since 1962 interest rates (working either directly or indirectly through the multiplier) appear to have had more influence on final sales than changes in the monetary base. Interest rates would be used only as a short-run indicator to help the Fed guide the economy to its desired NFS path, and not as a medium-term target. As the monetary stimulus is gradually reflected in an increase in the forecast growth of NFS, then interest rates could be allowed to rise.

There would be nothing novel in the use by the Federal Reserve of its own forecasts, since this is done already. In fact, the Fed is required to Congress to publish twice a year its outlook for nominal GNP growth and other variables. What would be new about NFS targeting would be a shift away from the Fed's tendency to "look at everything." Instead, the Fed would look at the natural unemployment rate in the long run, maintain the economy along a NFS path in the medium-run, and guide the economy to that path in the short run by looking at the behavior of interest rates, the monetary base (in periods of more quiescent money demand behavior), and the exchange rate. NFS growth would be transformed from a variable that the Fed forecasts, as at present, into a central objective of policy.

Some readers, like Fellner, may feel that it is impossible for the Fed to lean against velocity changes within the duration of the typical business cycle. The potential for the use of forecasts can be assessed with the evidence that has been compiled over the past twelve years by Stephen McNees. For every quarter since 1971:Q2 he has recorded the four-quarter-ahead forecast of nominal GNP change (and of other aggregate variables as well) for five leading commercial forecasting models. The value of these forecast changes in predicting actual four-quarter changes in nominal GNP can be assessed by running a regression in which the actual change is the dependent variable, and the forecast made four quarters previous to that change is the right-hand variable (a constant term is also included). The coefficients and t-ratios for such regression equations are shown here for three sample periods:

1972:Q1 - 1976:Q4	0.56	(2.42)
1977:Q1 - 1981:Q4	0.50	(2.56)
1977:Q1 - 1982:Q4	0.28	(0.80)

Thus the forecast changes do help to predict the actual changes, with a coefficient of about one-half. The comparison of the second and third sample periods indicates that forecasters made very serious errors in forecasting nominal GNP growth in 1982, so that a central bank reacting to stabilize forecasts made in late 1981 for late 1982 would have been unable to counteract the decline in velocity growth that actually occurred in 1982. As the year 1982 proceeded, the level of nominal GNP (and NFS) and the year-ahead forecasts thereof drifted further and further below a stable growth path, and thus a central bank operating to control a NSF target would have moved earlier to reduce interest rates.

The 1982 forecasting failure does not detract from the value of forecasts evident in the record for 1972-81. This record suggests that a central bank operating during 1976-81 to maintain stable growth in NFS at, say, 10 percent per annum would have moved much earlier toward restrictive policy actions than actually occurred in the historical record, for the McNees series shows that nominal GNP growth was forecast to exceed 10 percent for thirteen successive four-quarter periods--those ending in 1976:Q1 through 1979:Q1. It is this serial correlation in the deviation of actual and forecast nominal GNP changes from their mean value over the business cycle that supports an attempt by central banks to control NFS rather than a monetary aggregate.[15]

Objections to Targeting Nominal GNP Growth

A wide range of objections has been raised to the use of nominal GNP growth as the central medium-term operating target of the central bank. Some of these are included in the July, 1983, Congressional testimony of Paul Volcker, chairman of the Federal Reserve Board.[16] Critics do not all share the same objections; some feel, for instance, that nominal GNP targeting would give the Fed too much discretion, and some feel that the Fed would be hamstrung with too little discretion.

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[15] In more detailed tests, Mayer (1983) also concludes that forecasts are sufficiently accurate to allow the Fed to achieve a modest dampening of the business cycle.

[16] This testimony is included in U. S. Federal Reserve Board (1983).

1. Too much or too little discretion? One view, currently advocated by Milton Friedman, is that a central bank cannot be trusted to engage in the discretionary actions (e.g., changes in reserve growth) that would be required under a system of nominal GNP targeting. Central bank officials are viewed not as following the rational precepts of academic advisers, but rather as bureaucrats responding to short-run pressures from within and outside their organization. The Friedman solution, shared by some other monetarists, is to tie the hands of the irresponsible bureaucrats completely by limiting them to a simple rule, e.g., his recent proposal for the Fed to make "$X" hundred million of open-market purchases every Monday. The problem with this point of view, already documented above, is that stable growth in the monetary base has actually occurred in the past and has not prevented instability in the growth rates of monetary aggregates and nominal spending.

An opposite criticism is suggested by some Federal Reserve officials, including Chairman Volcker. The Fed should continue to "look at everything," or, in Volcker's words, "Decisions on monetary policy should take account of a variety of incoming information on GNP or its components. . . . This simply can't be incorporated into annual numerical objectives."[17] Yet the present approach of looking at everything has allowed the Fed in the past to allow nominal GNP growth to drift upward, as in the late 1960s and late 1970s, or to fall far below anyone's objectives, as in 1982. Another response to this criticism is that the central bank has no control over the division of nominal GNP growth between inflation and real GNP growth, and its proper business is

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[17] U. S. Federal Reserve Board (1983), p. 15.

to provide a "nominal anchor" for the economy.

2. The Fed can't control nominal GNP. The linkages between the Fed's direct control instruments (reserve growth and the discount rate) and nominal spending are loose and lags are long. In Volcker's words, "the channels of influence from our actions . . . to final spending totals are complex and indirect, and operate with lags, extending over years. The attempt to 'fine tune' over, say, a six-month or yearly period, toward a numerically specific, but necessarily arbitrary, short-term objective could well defeat the longer-term purpose.[18] But a nominal GNP growth target like that in Figure 2 is not "arbitrary" or "short term" but rather is designed to promote the Fed's basic long-term objective, which is achieving a soft landing that allows maintenance of steady real growth with moderate inflation. The length of lags has been exaggerated in some past research. Real activity responded within six to nine months to shifts in Federal Reserve policy in numerous past episodes, including its tightening in 1966, 1969, 1974, and 1981, and its loosening in 1967, 1971-72, 1975-76, and 1982. By focussing on the best current four-quarter ahead forecasts, the Fed could operate to counteract some of the extreme periods of excessive or insufficient nominal GNP growth. There is no need for the Fed to lean against short-term within-year movements that cannot be forecast and that, if quickly reversed, would have no adverse consequences.

3. Coordination with Fiscal Policy. Ideally monetary and fiscal policy would take coordinated action to achieve economic objectives. In some countries governmental institutions make this possible,

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[18]U. S. Federal Reserve Board (1983), p. 14.

and there can be a single objective agreed upon by both monetary and fiscal policymakers. An important criticism of nominal GNP targeting is that it allocates too much responsibility to the central bank. In the chaotic and uncoordinated policy setting of the U. S., acceptance by the Fed of sole responsibility for sustaining an economic recovery would appear to remove the incentive for Congress to make difficult decisions on the budget. Unfortunately, the built-in limitations of the American constitutional system have already, for better or worse, handed responsibility for macroeconomic policy to the Federal Reserve.

4. Avoidance of Accountability. This criticism states that if the central bank has a nominal GNP growth objective and misses its target, then it can avoid accountability by blaming other factors (fiscal policy, swings in consumer attitudes, etc.). Yet this problem already exists in the present system. The Fed failed to prevent either an undesired collapse of spending growth in 1982 or an explosion of double-digit money growth in 1982-83. It has already become expert in giving excuses--in this case financial deregulation and portfolio shifts. There will always be an irreducible minimum variance in velocity that will prevent the Fed from achieving stable spending growth, no matter whether its proximate operating target is the monetary base, money supply, or nominal spending itself.

Conclusion

Nominal spending cannot be controlled precisely. Forecasts are imperfect and will occasionally lead the government astray. The ultimate goal of guiding the economy smoothly to the natural unemployment rate and then maintaining that rate involves an unobservable variable that must be estimated, and any estimation procedure is open to controversy. Changes in institutions, for instance, can alter today's parameter values from those observed during earlier years of the sample period of estimation.

The empirical work in this paper is limited to evidence for the postwar United States. A parallel research effort will be required to determine the procedures for the conduct of monetary policy that would be optimal in other nations. The merits of controlling nominal GNP or final sales growth, as opposed to the monetary base or a money supply concept, depend partly on the historical record regarding the stability of velocity and the "advance knowledge" regarding nominal GNP movements contributed by monetary aggregates. For instance, a target based on forecasts of nominal final sales growth, rather than the actual outcome, hinges on the availability of forecasts that actually make a positive contribution to the prediction of nominal sales growth four quarters ahead. In the absence of good forecasts a choice would have to be made between targeting a moving average of actual nominal sales changes, a monetary aggregate, or another concept like liquid assets or aggregate credit.

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